CLAIMS

1. Polymers comprising a polymer backbone having pendant groups, obtainable by polymerizing monomers having such groups, characterized in that said polymers are obtained by copolymerizing monomers of at least three different classes selected from:

(a) monomers having sulphate groups
(b) monomers having sulphonate groups
(c) monomers having sulphamate groups, and
(d) monomers having polyoxyalkylene ether groups

2. Polymers comprising a polymer backbone having pendant groups, obtainable by polymerizing monomers having such groups, characterized in that said polymers are obtained by copolymerizing monomers of at least three different classes selected from:

(a) monomers having sulphate groups
(b) monomers having sulphonate groups
(c) monomers having sulphamate groups, and
(d) monomers having polyoxyalkylene ether groups
(e) monomers having zwitterionic groups

3. Polymers according to Claim 1 or 2 characterized in that said monomers in Classes (a), (b) and/or (c) have the formula

$$CH_2=CR_1\text{-}C(=O)\text{-}Z_1\text{-}R_2\text{-}Y_1\text{-}X_1$$

where

R_1 is H or CH_3;

R_2 is a linear or branched alkylene of 2-10 carbon atoms, phenylene, phenyl alkylene with 1-10 carbon atoms in the alkylene structure or the polyoxyalkylene structure $[CH_2\text{-}CHR_1\text{-}O]_n$ where R_1 is H or CH_3 and n is from 2 to 50;

Z_1 is oxygen (-O-) to give an ester linkage or secondary amine (-NH-) to give an amide linkage;

Y_1 is (-O-) or (-NH-) or is absent; and

X_1 is sulphonate ($-SO_3^-$).

together with an acceptable balancing cation.

4. Polymers according to Claim 1 or 2 characterized in that said monomers in Classes (a), (b) and/or (c) have the formula:

$$CH_2=CR_1\text{-}R_2\text{-}Y_1\text{-}X_1$$

where

R_1 is H or CH_3;

R_2 is a linear or branched alkylene of 1-10 carbon atoms, phenylene, phenyl alkylene with 1-10 carbon atoms in the alkylene structure or the polyoxyalkylene structure $[CH_2\text{-}CHR_1\text{-}O]_n$ where R_1 is H or CH_3 and n is from 2 to 50;

Y_1 is (-O-) or (-NH-) or is absent; and

X_1 is sulphonate ($-SO_3^-$).

together with an acceptable balancing cation.

5. Polymers according to any one of Claims 1 to 4 characterized in that the monomer containing sulphate groups is selected from salts of 2-sulphatoethyl methacrylate, 2-sulphatoethyl acrylate, 3-sulphatopropyl methacrylate, 3-sulphatopropyl acrylate, 4-sulphatobutyl methacrylate, 4-sulphatobutyl acrylate, allyl sulphate, methyl allyl sulphate, 3-buten-1-sulphate, 3-buten-2-sulphate, 2-methyl-2-propane-1-sulphate, 2-methyl-3-buten-1-sulphate, 3-methyl-3-buten-1-sulphate, 2-sulphatoethyl methacrylamide, 2-sulphatoethyl acrylamide, 3-sulphatopropyl methacrylamide, 3-sulphatopropyl acrylamide, 4-sulphatobutyl methacrylamide, 4-sulphatobutyl acrylamide, sulphato polyoxyalkylene methacrylate, and sulphato polyoxyalkylene acrylate.

6. Polymers according to any one of Claims 1 to 5 characterized in that the monomer containing sulphonate groups is selected from salts of 2-sulphoethyl methacrylate, 2-sulphoethyl acrylate, 3-sulphopropyl methacrylate, 3-sulphopropyl acrylate, vinyl sulphonate, allyl sulphonate, methyl allyl sulphonate, p-styrene sulphonate, 2-acrylamide-methylpropanesulphonate, 3-sulphopropyl ethoxy methacrylate, 3-sulphopropyl ethoxy acrylate, 3-sulphopropyl polyoxyalkylene methacrylate, and 3-sulphopropyl polyoxyalkylene acrylate.

7. Polymers according to any one of Claims 1 to 6 characterized in that the monomer containing sulphamate groups is selected from salts of 2-

sulphamatoethyl methacrylate, 2-sulphamatoethyl acrylate, 3-sulphamatopropyl methacrylate, 3-sulphamatopropyl acrylate, 4-sulphamatobutyl methacrylate, 4-sulphamatobutyl acrylate, allyl sulphamate, methyl allyl sulphamate, 2-sulphamatoethyl methacrylamide, 2-sulphamatoethyl acrylamide, 3-sulphamatopropyl methacrylamide, 3-sulphamatopropyl acrylamide, 4-sulphamatobutyl methacrylamide, 4-sulphamatobutyl acrylamide, sulphamato polyoxyalkylene methacrylate and sulphamato polyoxyalkylene acrylate.

8. Polymers according to any one of Claims 1 to 6 characterized in that said monomers in Class (d) have the formula

$$CH_2=CR_3-C(=O)-O-[CH_2-CHR_4-O]_n-R_7$$

where R_3 and R_4, which may be the same or different, are each H or CH_3; R_7 is H or alkyl with from 1 to 5 carbon atoms; and n is from 2 to 50.

9. Polymers according to any one of Claims 1 to 8 characterized in that said polymers comprise heparin monomer units having heparin, linked to a polymerizable moiety having a carbon-carbon double bond.

10. Polymers according to any one of Claims 1 to 8 characterized in that said polymers comprise monomer units having hirudin, warfarin or hyaluronic acid linked to a polymerizable moiety having a carbon-carbon double bond.

11. Polymers according to Claim 9 characterized in that the heparin monomer units comprise vinyl, allyl, methallyl, acrylate or methacrylate groups.

12. Polymers according to Claim 9 or 11 characterized in that the heparin monomer has the formula:

$$CH_2=CR_5-C(=O)-O-CH_2-CHR_6-[O-CH_2-CHR_6-]_n-O-C(=O)-Heparin$$

or

$$CH_2=CR_5-C(=O)-O-CH_2-CHR_6-[O-CH_2-CHR_6-]_n-O-C(=O)-O-Heparin$$

where R_5 and R_6, which may be the same or different, are each H or CH_3; and n is from 0 to 49.

13. Polymers according to any one of Claims 1 to 12 characterized in that said polymers contain additional monomer units derived from acrolein.

14. A medical device having a coating of a polymer according to any one of Claims 1 to 13.

15. A method of forming a coating of a polymer according to any one of Claims 1 to 14 on a medical device, characterized by forming an ungelled partial polymer by reacting a solution of an amine polymer with a crosslinking agent, activating the medical device by solution coating with said partial polymer, and depositing the polymer on the resulting activated medical device.

16. A method according to Claim 15 characterized in that the amine polymer is polyethylene imine.

17. A method according to any one of claims 15 and 16 characterized in that the crosslinking agent is an aliphatic monoisocyanate or diisocyanate.

18. A heparin monomer having the formula:

$CH_2=CR_5-C(=O)-O-CH_2-CHR_6-[O-CH_2-CHR_6-]_n-O-C(=O)-Heparin$

or

$CH_2=CR_5-C(=O)-O-CH_2-CHR_6-[O-CH_2-CHR_6-]_n-O-C(=O)-O-Heparin$

where R_5, R_6 and n have the meanings given in Claim 12.

19. A method of forming a heparin monomer according to Claim 16, characterized in that a hydroxyl terminated compound of the formula:

$CH_2=CR_5-C(=O)-O-CH_2-CHR_6-[O-CH_2-CHR_6-]_n-OH$

is reacted with carbonyldiimidazole to form an activated imidazoyl carbonate of the formula:

$CH_2=CR_1-C(=O)-O-CH_2-CHR_2-[O-CH_2-CHR_2-]_n-O-C(=O)=Im$

wherein R_5, R_6 and n have the meanings given in Claim 18 and the activated imidazoyl carbonate is coupled with heparin at a basic pH.

20. A coating material comprising a polymer according to any one of claims 1 to 13.

21. A coating material according to Claim 20 characterized in that it is adapted for use on a surface of a medical device.